CLAIMS

1. An organic contaminant molecule sensor for use in a low oxygen concentration monitored environment, the sensor comprising an electrochemical cell comprising a solid state oxygen anion conductor in which oxygen anion conduction occurs at or above a critical temperature T_c, an active measurement electrode formed on a first surface of the conductor for exposure to the monitored environment, the measurement electrode comprising material for catalysing the oxidation of an organic contaminant molecule to carbon dioxide and water, an inert measurement electrode, formed on the first surface of the conductor adjacent to and independent from the active measurement electrode, for exposure to the monitored environment, the inert measurement electrode comprising material that is catalytically inert to the oxidation of an organic contaminant molecule, and a reference electrode formed on a second surface of the conductor for exposure to a reference environment, the reference electrode comprising material for catalysing the dissociative adsorption of oxygen; means for controlling and monitoring the temperature of the cell; means for controlling the electrical current I_a flowing between the reference electrode and the active measurement electrode and the electrical current I_i flowing between the reference electrode and the inert measurement electrode, thereby to control the flux of oxygen anions flowing between the reference electrode and the active and inert measurement electrodes respectively; and means for monitoring the potential difference between the active measurement electrode and the inert electrode, whereby in the absence of organic contaminant molecules the potential difference V_{sense} between the active and inert measurement electrodes assumes a base value V_b and in the presence of organic contaminant molecules the potential difference V_{sense} between the

active and inert measurement electrodes assumes a measurement value V_m, the value $V_m - V_b$ being indicative of the concentration of organic contaminant molecules present in the monitored environment.

2. A sensor according to Claim 1, wherein the active measurement electrode is coated with or formed from material selected from the group comprising rhenium, osmium, iridium, ruthenium, rhodium, platinum and palladium and alloys thereof.

3. A sensor according to Claim 2, wherein the alloys include one or more elements selected from silver, gold and copper.

4. A sensor according to any of Claims 1 to 3, wherein the reference electrode is formed from material able to catalyse the dissociation of oxygen.

5. A sensor according to Claim 4, wherein the reference electrode is formed from platinum, palladium or other metal able to dissociatively adsorb oxygen or any alloy thereof.

6. A sensor according to any preceding claim, wherein the solid state oxygen anion conductor is selected from gadolinium doped ceria and yttria stabilised zirconia.

7. A sensor according to any preceding claim, comprising a counter electrode positioned adjacent to the reference electrode.

8. A sensor according to Claim 7, wherein the counter electrode is formed from platinum, palladium or other metal able to dissociatively adsorb oxygen.

9. A sensor according to any preceding claim, wherein the reference environment is a gaseous source of oxygen.

10. A sensor according to any of Claims 1 to 8, wherein the reference environment comprises a solid-state source of oxygen.

11. A sensor according to Claim 10, wherein the solid state source is selected from a metal / metal oxide couple (optionally Cu / Cu_2O or Pd / PdO), or a metal oxide /metal oxide couple (optionally Cu_2O / CuO).

12. A sensor according to any preceding claim, wherein the means for controlling or monitoring the temperature of the cell comprises a heater and thermocouple arrangement.

13. Use of a sensor according to any preceding claim for monitoring the levels of trace organic contaminants in a low oxygen concentration monitored process environment.

14. A method of monitoring the levels of trace organic contaminants in a monitored process environment, the method comprising the steps of providing an electrochemical sensor comprising a solid state oxygen anion conductor in which oxygen anion conduction occurs at or above a critical temperature T_c, an active measurement electrode formed on a first surface of the conductor for exposure to the monitored environment, the measurement electrode comprising material for catalysing the oxidation of an organic contaminant molecule to carbon dioxide and water, an inert measurement electrode, formed on the first surface of the conductor adjacent to and independent from the active measurement electrode, for exposure to the monitored environment, the inert measurement electrode comprising material that is catalytically inert to the oxidation

of an organic contaminant molecule, and a reference electrode formed on a second surface of the conductor for exposure to a reference environment, the reference electrode comprising material for catalysing the dissociative adsorption of oxygen; raising the temperature of the above the critical temperature T_c; passing an electrical current I_a between the reference electrode and the active measurement electrode and a electrical current I_i between the reference electrode and the inert measurement electrode, thereby to control the flux of oxygen anions flowing between the reference electrode and the active and inert measurement electrodes respectively; and monitoring the potential difference between the active measurement electrode and the inert electrode, whereby in the absence of organic contaminant molecules the potential difference V_{sense} between the active and inert measurement electrodes assumes a base value V_b and in the presence of organic contaminant molecules the potential difference V_{sense} between the active and inert measurement electrodes assumes a measurement value V_m, the value $V_m - V_b$ being indicative of the concentration of organic contaminant molecules present in the monitored environment.

15. A method according to Claim 14, wherein I_a is in the range from 10nA to 100μA.

16. A method according to Claim 14 or Claim 15, wherein the sensor is provided with a counter electrode adjacent the reference electrode.

17. A method according to any of Claims 14 to 16, wherein the reference environment is a gaseous source of oxygen at atmospheric pressure, preferably atmospheric air.

18. A method according to any of Claims 14 to 16, wherein the reference environment comprises a solid-state source of oxygen.

19. A method according to Claim 18, wherein the solid state source is selected from a metal / metal oxide couple (optionally Cu / Cu_2O or Pd / PdO), or a metal oxide /metal oxide couple (optionally Cu_2O / CuO).

20. An organic contaminant molecule sensor for use in a low oxygen concentration monitored environment, the sensor comprising an electrochemical cell comprising an oxygen anion conductor in which oxygen anion conduction occurs at or above a critical temperature T_c, an active measurement electrode in contact with the conductor for exposure to the monitored environment, the measurement electrode comprising material for catalysing the oxidation of an organic contaminant molecule to carbon dioxide and water, an inert measurement electrode, in contact with the conductor independent from the active measurement electrode, for exposure to the monitored environment, the inert measurement electrode comprising material that is catalytically inert to the oxidation of an organic contaminant molecule, and a reference electrode in contact with the conductor for exposure to a reference environment, the reference electrode comprising material for catalysing the dissociative adsorption of oxygen; means for controlling and monitoring the temperature of the cell; means for controlling the electrical current I_a flowing between the reference electrode and the active measurement electrode and the electrical current I_i flowing between the reference electrode and the inert measurement electrode, thereby to control the flux of oxygen anions flowing between the reference electrode and the active and inert measurement electrodes respectively such that the NEMCA effect is activated; and means for monitoring the potential difference between the active measurement electrode and

the inert electrode, whereby in the absence of organic contaminant molecules the potential difference V_{sense} between the active and inert measurement electrodes assumes a base value V_b and in the presence of organic contaminant molecules the potential difference V_{sense} between the active and inert measurement electrodes assumes a measurement value V_m, the value $V_m - V_b$ being indicative of the concentration of organic contaminant molecules present in the monitored environment.